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HONOR SOCIETIES[1]

By Dr. E. P. LYON

DEAN OF THE UNIVERSITY OF MINNESOTA MEDICAL SCHOOL

THE other day a recent graduate of our school came in to see me. He had just completed his internship and was trying to decide whether to begin practice or to enter upon graduate study. Across his stomach—it was too low for his heart!—I observed a watch chain from which dangled four golden keys. There was Phi Beta Kappa. He was the best scholar in his class in a well-known college, and he hung that key on his chain when he took his A.B. degree. There was Sigma Xi. He gathered that in his second year of medicine by spending his spare time—oh, yes! a good man has spare time!—and his vacations in the bacteriological laboratory and writing a nice original paper. The third was Alpha Omega Alpha. Those present know how he got that. He stood second in his class in medical school, and the Minnesota Chapter took several dollars of his (father's?) money and presented him with the mystic emblem which goes Revelations one half better, for it says, "I am Alpha and Omega and Alpha over again." Finally there was the key of the licentiate of the National Board of Medical Examiners.

As I talked with this young man I remember thinking that each of those jewels stood for a good job of work. I knew he had earned each one of them. I also thought that each combination of Greek letters represented a motto—a phrase of admonition and guidance. And I thought, "This boy deserves his baubles, but I doubt whether he could tell in a single case what the letters stand for." And I thought, "What storehouses will those keys open for this man? Alas, they will open no locks. He will have to pick the locks. I think he can do it."

Just then one of his old classmates came in, hit my man on the back and scoffed: "O boy! Lamp the decorations! Looks like a row of anchors on the side of a battle-ship! Say, Saint Peter, you ought to get a key ring and carry those things in your hip pocket."

[1] Delivered before the Alpha Omega Alpha Society, St. Louis University Medical School.

But the proud possessor of the keys of heaven—fortunately he has a sense of humor—retorted without turning a hair: "You poor moron! What do you know? I might have had a Phi Lambda Oop., but they cut me off because I said I was going to be a doctor and not a chemist. I'll give you the bunch if you'll tell me where there's a good place to hang out my shingle."

Of the making of honor societies there is no end. The list of them reads like the roster of radio stations—so many and so varied that one wonders that the abbreviated Greek alphabet affords sufficient combinations. One hears faculty tales that in one college at Minnesota there are enough honor societies to provide membership for every senior student with a "C" average, though, of course, it doesn't work out quite that way. One actually learns of a super honor society—I forget its lettering—which takes only the best of the members of the regular honor societies. One contemplates the possibility of an extra, ultra, paramount and preeminent society which will initiate only the upper 10 per cent. of the super society. One waits breathlessly for the formation of an honor society for those who fail to make an honor society. One is told of Fi Beter Capper, at an eastern university, whose standard is said to be that candidates must flunk three fourths of their courses and yet remain in school.

What does all this mean? Or does it mean anything? Is the honorary fraternity just a mutual admiration organization—an amusing and harmless association of those afflicted with a superiority complex? Or is the honor society—are some honor societies—representative of real superiority, perhaps hard to define and analyze but a complex and actual force?

I am not sure that we can answer these questions. Perhaps they can not be answered. But before we try to answer let us simplify the task by eliminating from consideration all those societies in which a social or personality factor affects the selection of members. Let us leave to the barber and cosmetic schools the bestowal of honors founded on the color of eyes or hair. Let us leave to the Blue Book and Social Register prestige founded on good fellowship and social graces. Let us even omit—but regretfully, for we shall lose persons high in public esteem—let us omit those societies which stress physical prowess, the athletic honor societies. Let us be old-fashioned enough to consider scholarship as the aim of higher education and include in our discussion only those societies whose sole criterion of membership is scholarship.

Also before we try to answer the questions let us be clear to start with that we do not imply too much. Membership in an honor society means that, in the judgment of some body of persons, one has stood above his fellows in some particular group and situation and in some particular respect. Phi Beta Kappa means high scholarship in an arts college among a group of arts college seniors. Alpha Omega Alpha means high scholarship in the subjects of the medical curriculum, under the conditions prevailing in a particular school. One can not expect a group chosen at this age and in these conditions to be fully correlative with a group which might be chosen after ten years' further development in contact with the world.

Furthermore, the judging of scholarship involves the comparison of marks and brings in all the shortcomings of the marking system. We know that no system of grading is completely dependable. If we arrange 100 men in order of scholarship marks, we know that number 1 is surely better than number 100—better than number 50. But we are not at all sure that number 10 is better than number 11 or number 12. If we choose the upper 10 per cent. or 25 per cent. for an honor group we may reject some who ought to be included, may include some whom a perfect system would leave out.

This implies that reasonable humility is called for, and that we who wear the keys ought not to be too cocky in our attitude toward those who ornament their vests in some other way.

These errors in ranking students become greater when the comparison is made on the basis of an elective curriculum. For example, in the arts college, how is one to compare a student who majors in mathematics with one who majors in French literature? I have understood that there is more or less jockeying and more or less heartbreaking in Phi Beta Kappa elections because of interdepartment rivalry, particularly as regards the last and border-line cases under consideration. This may be less true in elections to Alpha Omega Alpha because of a more fixed curriculum. But to some extent a factor of uncertainty must always be there.

Note further that rank established by a comparison of marks is a judgment made on the cold facts of the record. It indicates just that and no more. Perhaps, however, number 10 on our imaginary list had all his time for study, whereas number 11 had to work for a living. Perhaps number 10 was well while number 11 had a sick spell. Under other circumstances their relative ranks might have been reversed. Nevertheless, the poorer man will always wear the key, and the other fellow must be content with a Red Cross button or join the Elks. There is no way of helping this situation.

Let us bear in mind, then, that elections to honor societies are subject like everything in life to fallible human judgment made on fallible human data.

Founded on averages for a large number of people, they represent fact. They are approximately correct for the limited situations and groups they cover, but not absolutely so as regards individuals. This may be some consolation for those who fail to get in and ought to exert a tempering influence on the superiority complex of those who make the honor group.

But going a step further let us assume that we have picked the upper 10 per cent. for an honor society and that they really are the top 10 per cent. They are the best men, the most intelligent, the steadiest workers. They deserve the honor. But what does it signify?

How much of their superiority did they make for themselves? Some, perhaps, but by no means all. They were born good. The honor by good rights should be shared with their grandparents. This seems certainly true for that part of our make-up spoken of in a limiting way as intelligence. It seems probable that it is true in considerable degree for the indefinite qualities sometimes called temperament. That one man works harder than another, has more ambition, is less easily discouraged, is able better to "put it across," has better health and more strength—all these may be partly hereditary.

The business instinct which caused the servant who received five talents to put them into trade and gain other five talents may have come from his father as truly in a material sense as the five talents of capital with which he began his financial operations came from his master. Perhaps he got it, as in a purse, included in the chromosomes of the parental sex cell. And the lack of imagination and initiative which caused the one talent servant to hide his money in the earth may just as truly have been inherited—doubtless from the maternal side of the house!

I am not belittling the influences of environment. I am not saying that education is futile. I am not maintaining that the formation of useful habits—whether of study or in other directions—is not to be striven for and is not immensely valuable when acquired. I am saying that in selecting any superior group a large hereditary factor comes in. Personally I believe it is the largest factor. Anyway it is a large factor. And admitting this, it behooves the wearer of keys to be moderately humble and take a short course in ancestor worship.

And now to proceed one step further in the debunking of our own group, Alpha Omega Alpha, what can be said on the proposition that election to this society is a prophecy of success in the practice of medicine? Does the brilliant man make a better doctor than his less well-endowed classmate?

A few years ago I should have fallen back on my favorite doctrine of averages. I should have said there will be some lack of success among the brilliant top men and there will be many successes among the much larger number of the average and poor men. But a larger share of the upper 25 per cent. will succeed than of the lower 75 per cent.

But gradually I changed my mind. I was impressed more and more that success in the practice of medicine depends largely on qualities which the classroom and examination do not reveal or test. These qualities are sometimes heaped together under the head of personality, sometimes opprobriously denominated "salesmanship." (Yes, it is a fact that a doctor must be able to sell himself before he can serve.)

He must be able to create confidence. He must be able to get the sick man's point of view. He must—or at least, should—have a sympathetic attitude. He must be able to mingle on a basis of mutual interest with all classes of people. He must minister to his patients. He must be a *minister!*

So true is this that I have sometimes characterized the practice of medicine as 50 per cent. science, 50 per cent. skill in technical procedure and 100 per cent. ministry! A 200 per cent. man—that is a good doctor!

Whatever you call that extra 100 per cent.—that indispensable, intangible, psychological something that makes a good doctor—our methods of choosing medical students take it very little into account. Our curriculum and teaching methods do not measure it or in large degree, I think, develop it. The graduate has it or has it not, finds it or does not find it, owing to influences beyond our knowing or, at any rate, beyond our immediate power to gauge and direct.

Now if a large part of one's qualification for making a success in the practice of medicine is beyond the purview of those who select the members of our honor group, you will not be surprised—nor was I—to learn that the successful men in medicine come about equally from those who stood in the upper, middle and lower thirds of their medical school classes. The survey was made by the Commission on Medical Education and included over 1,600 physicians. These were judged successful by fellow practitioners. The criterion was not financial but rather sound medical practice—good service to the people—which, you are aware, is a thing that fellow members of the craft know but which patients unfortunately do not know.

So, if the members of Alpha Omega Alpha here present have foreseen themselves successful beyond the average of their classmates, if they have envisaged crowded waiting rooms and a multitude of grateful patients, this is the time to debunk; this is the time to deflate. Apparently they will get no more of that form of success called success in medical practice than their key-less companions.

But now that we are all prostrate and reduced to the common level—let us key wearers reexamine our position and try to find out just what bulwarks and ammunition we have. It may be that the honor societies are justified after all.

Let us look at the history of a few of them.

Phi Beta Kappa is by far the oldest, having been founded in 1776. For more than fifty years it was a secret fraternity like the others we know so well, of which it was the first. In fact, all the rest are imitations of early Phi Beta Kappa. In 1831 it gave up its "secrets." Gradually it perfected its system of election until now it is practically speaking a scholarship honor society in arts colleges.

How do the members of Phi Beta Kappa show up in later life? I suppose no statistical study of the success of Phi Beta Kappa men in contrast with those college graduates who are not members has ever been made. But the list of great ones in the society is impressive. I quote from their booklet: "Eight have been chosen to the Presidential office. . . . The Chief Justice and four Associate Justices of the Supreme Court are Phi Beta Kappa men. A great host of them adorn the learned professions. Others are noted scientists." A copy of the *Phi Beta Kappa Key* recently before me is largely taken up with accounts of the installation of Phi Beta Kappa men as college presidents. Eight new presidents are listed in that particular number of the *Key*. One, Dr. Arthur Stanley Pease, was installed at Amherst, and the account of his inauguration modestly stated that all presidents of Amherst from 1821 to date, ten in number, have been Phi Beta Kappa members.

Yes, the *Key* does a nice job of advertising! But there can be no doubt that this honor society has among its members a very large number of persons who have become successful in callings requiring intelligence and scholarship. It does select a superior group.

Parenthetically, it must be said that it does not—can not—get *all* the good and great. How could it? It confines its membership to arts college graduates. At Minnesota high-grade graduates of the nearly related College of Education are not eligible. Moreover, not all good colleges have chapters. Hoover, as an engineering student, would not have been eligible even if there had been a chapter at Stanford when he graduated. And the Happy Warrior, poor fellow—he can never join a "frat," never wear a lettered sweater, never sport a key. Yet some of us think his cerebrum is a rather unusual and effective piece of architecture.

Ibsen calls the great of the earth—I have the quotation from a book of Hamlin Garland's—"an aristocracy of mind, of character and of will." Phi Beta Kappa includes among its members a goodly number of this nobility but by no means all. Nor should we think that all the aristocracy of medicine will wear the key of Alpha Omega Alpha. There are good fish that do not get into the net. Furthermore, as I indicated earlier, quite a few medium-sized fish get their gills entangled in the meshes during the fishing operations.

(This is the last debunking I shall do. Hereafter, Alpha Omega Alpha, you may raise your head, proud though somewhat battered about the eyes.)

And returning to Phi Beta Kappa let us ask what else the society has accomplished. Apparently customs differ among the chapters, but a frequent thing has been the support of annual addresses on appropriate topics by some of the country's best thinkers. Some of these addresses have been published by the society. Delving into the volume before me I note orations by such men as Ralph Waldo Emerson on "The American Scholar," George William Curtis on "The American Doctrine of Liberty," Wendell Phillips on "The Scholar in a Republic," Charles W. Eliot on "Academic Freedom," Woodrow Wilson on "The Spirit of Learning."

From Wilson's address I cull the following:

> What we should seek to impart in our colleges . . . is not so much learning itself as the spirit of learning. It consists in the power to distinguish good reasoning from bad, in the power to digest and interpret evidence, in a habit of catholic observation and a preference for the non-partisan point of view, in an addiction to clear and logical processes of thought and yet an instinctive desire to interpret rather than to stick in the letter of the reasoning, in a taste for knowledge and a deep respect for the integrity of the human mind.

I do not know of any better formulation of the general aims of our medical schools or the aims of Alpha Omega Alpha than these sentences by Woodrow Wilson. If he had used the expression "scientific spirit" you would all see that this is true.

We will admit, then, that Phi Beta Kappa in fostering its annual addresses has done something fine and worthy of imitation.

According to members of the Minnesota faculty the competition for Phi Beta Kappa is a salutary influence among undergraduates. One infers that the good effects are found both among those who are elected and among those who fail to make the fraternity. The boy who fails to get a key may be heartbroken at the time, but he has acquired the better thing—the habit and love of study. One opines that anything which stimulates a desire for scholarship in these days of extracurricular activities and of sentiment against serious study is to be commended.

We have made, it seems, a good case for Phi Beta Kappa; and those who have its emblem may now polish it up and restore it to a prominent position over the abdomen. With lapse of years adipose will collect there and tip the key more and more into the line of vision of colleagues and neighbors.

Sigma Xi is the next I shall mention. It was founded at Cornell in 1886 with the intention that it should be a scientific Phi Beta Kappa. Sigma Xi now has forty-five chapters. It has become more representative of productive scholarship than the older society. Its motto means "Companions in Zealous Research." Seldom, if ever, is membership granted on the basis of excellence in science courses alone. An original publication or evidence of investigative ability is required.

I consider that it is a great honor to a young man or woman to be admitted to Sigma Xi. I think that earnest striving for this honor has helped a good many students to grow. I wish high-grade medical students would oftener do the research work which would make them eligible to this society. It would stimulate able students in science methods and scientific thinking; and even if they did not become investigators, they would be better doctors.

Sigma Xi as an organization fosters activities quite similar to Phi Beta Kappa. Its annual addresses are on scientific subjects, and not a few of them have been distinguished.

The society and its individual chapters have helped research and aided in the spread of the scientific spirit in a variety of ways. There is quite an extensive literature on this society. If you have a Sigma Xi key, polish it up and put it out in front.

I might, if time permitted, refer to three or four other societies which are worthy of high rating. But now I must go on to Alpha Omega Alpha, the society under which this meeting was promoted and of which many of us are members. We may have plucked a few feathers out of its war bonnet, but we are proud of our tribe none the less.

This fraternity was founded in 1902 at the College of Physicians and Surgeons, Chicago, now the Medical School of the University of Illinois. The founder was William W. Root, a senior. Eight others with Root were charter members. It was purely a student movement. Not until later did faculty members have a hand in the organization.

It was a time of low standards in medical education—eight years before the famous Flexner report. There were about 160 medical schools in the United States—twice as many as now. Many of these were purely commercial in character. The standard of admission in almost all schools was nominally high-school graduation, but really lower. The schools advertised and proselyted in a shameful manner. The unsavory traditions of medical school life were intensified by a liberal sprinkling of uncouth and rowdy students. You who are accustomed to the average reasonably high culture and decency among medical students now would not have been at home among those who studied medicine twenty-five years ago. I remember when I went to St. Louis University Medical School in 1904 they killed all my frogs by spitting tobacco into the aquarium. They were a rough but jolly lot.

Character is a difficult thing to judge in the absence of "overt acts," but probably the common impression is correct that there were more drinking, sex irregularity, cheating and general dishonesty than among a similar group now. At any rate they were louder about it.

At Physicians and Surgeons Root and his companions undertook a "positive stand for better things." Their ideals included not only good scholarship but honesty and decency—in a word, character. Of course they could have had in mind no picture of what their little effort would grow into. But the germs of the present society were in the ideals of that group of seniors at the old P. and S. Root states that the first meeting was in the bacteriological laboratory. Perhaps there was prophetic significance in the presence of culture media and incubator. Just imagine what might have followed if the society had been born in the pathologic department!

Whatever may have been the external influences, there can be no doubt as to the viability of Alpha Omega Alpha's germ-plasm. In two months there was a chapter at Rush; a little later, one at Northwestern. There are now thirty-six chapters. So far as careful judgment can determine they are in the best medical schools of the United States and Canada. The society represents an honor group of colleges as well as of individuals.

While the original idea was wholly of student origin, the society owes much to faculty advice and help. Professor Winfield Scott Hall, of Northwestern, and Professor Walter B. Cannon, of Harvard, are two to whom the organization owed much during the formative period.

It is particularly enjoined by the constitution that "unpopularity of a student shall not be a bar to his election." Further, no student may be rejected on character grounds without a full statement of reasons and, presumably, of evidence. The motto means "To be worthy to serve the suffering." The key has an anatomical significance. The initiation consists of no more than the affirmation of the Oath of Hippocrates and the signing of the constitution. Usually there are explanatory remarks concerning the history, con-

stitution and aims of the fraternity, by some faculty member.

Just as the Oath of Hippocrates is to be observed not as literally applying to present-day medicine but rather in the spirit, so the force of Alpha Omega Alpha lies not in the formal organization but in its ideals. These again are but the highest ideals of the honorable profession to which you all expect to belong, with the addition of the desirable but not always attainable ideal of high scholarship. It may be said, therefore, that any physician who serves his patients according to the highest canon of the profession is an Alpha Omega Alpha in essential spirit.

The society merely marks or strives to mark those of the greatest intellectual capacity—as I have before said. It is a part—a part only—of the "aristocracy of mind, of character and of will." This aristocracy is largely, as I have remarked, as truly hereditary as any feudal nobility—only this one is governed by the laws of biology rather than those of primogeniture. The only common law is that of *noblesse oblige*.

Noblesse oblige—obliges what? Obliges all, it seems to me, that superior talent, character and will can accomplish. Obliges from the organization standpoint all that the united group can bring about for the common good of the profession in which this aristocracy exists. It should strive for better medical education, better teaching, fuller medical knowledge, better medical practice, better medical service for all the people, better public health, better understanding and respect for medicine and doctors on the part of the public. In these directions the society as a national unit and as chapter groups is moving.

Like the previously mentioned societies Alpha Omega Alpha has fostered annual addresses, usually before large audiences of medical men. Some of these have been distinguished contributions. Certain chapters have offered prizes for original investigation. Some have started loan funds for needy students. Some have conducted lecture courses or formal programs similar to those of medical societies. One at least has assisted the library of the school in which it is located. One has organized as a research club. One inaugurated tuberculosis clinics in a neighboring city.

There are many valuable things which a chapter can do. No chapter should be content with only an annual meeting, banquet and initiation.

All chapters, so far as I know, have exercised a stimulating influence on undergraduate scholarship. Inquiring into this matter I have met the suggestion that the influence would be greater if efforts were made to call the attention of freshmen and sophomores to the existence and aims of the society. One chapter offers a prize for the best student in the sophomore group. I pass these suggestions on to the local chapters.

Noblesse oblige—and what of the individual member? Surely to use his God-given ability to the fullest. "An aristocracy of mind, of character and of will." Woe to him who falls down on the last of the trilogy. Woe to him to whom the stimuli to highest achievement he had while in school fail when he gets away from the bracing atmosphere of the educational environment. He must become self-sufficient, self-starting. He must supply his own stimuli. "The sin I impute to each frustrate ghost is the unlit lamp and the ungirt loin." And sinner of sinners is he who lets his lamp, once lighted, go out, and drops the mantle once girt about his loins.

But more specifically and in conclusion, I think we must look to Alpha Omega Alpha for a large part in the progress of medical science. I think a goodly portion of the new and useful knowledge during the coming years will come from the members of this society. I think that in larger ratio than its membership indicates it will supply the medical teachers, writers, investigators and those who while in active practice make noteworthy contributions to medical knowledge and medical literature.

And why do I think so when I have told you already that you may expect only your proportion of the successful medical practitioners? Because I think that those qualities which make the teacher or investigator are the ones which scholarship signifies and this society represents.

The successful doctor needs a good but not a superior intelligence. The situations he faces, the associations of ideas he is required to make, the judgments he is called upon to pronounce are usually familiar situations, associations, judgments. It takes only reasonable ability and knowledge now to pilot a ship across the Atlantic. It took a genius in the day of Columbus. Almost any reasonably intelligent doctor with some technical skill can do now what McDowell or Marion Sims did. It took supermen to do it the first time.

The characteristic of high intelligence is the ability to make new associations, the ability to see new ideas and new arrangements or relations of ideas. The characteristic demand of research is first for new observation; but more, for new associations of new or old observations and for new methods. The research man is he who knows what to look for. The research man is he who sees what he isn't looking for. The research man is the one like Claude Bernard or Jacques Loeb who capitalizes his failures. These qualities go with the keenest intelligence.

I honestly believe, members of Alpha Omega Alpha, that another generation will see a large majority of

the professorships in medical schools, the directorships and other posts in research institutes, the editorships of medical journals held by those who as undergraduates were elected to Alpha Omega Alpha. New methods and instruments and diseases will be named for you. The author's index in medical literature will be, in large degree, an A. O. A. directory. The text-books will bear your names. The handbooks of research will contain your biographies. You will even be mentioned in "Who's Who," which is almost as bad as having a pyramid named after you.

Medical practice needs good men. Medical practice is an honorable and useful calling. But I believe that teaching and research need men of A. O. A. caliber even more than the practice of medicine needs them. I direct your eyes to the immensity of the unknown. I parody Browning:

Contrast
The petty Known, the Unknown vast.

Bring your great talents, Alpha Omega Alpha, like Columbus to the shore of the unknown. Chart new pathways, sound new depths, dare new winds and currents, visit strange lands, bring back new fruits—then shall ye be great. Then shall ye be dukes and kings in the aristocracy of intellect. Then shall ye deserve your heritage—and your key.

OBITUARY

RICHARD MILLS PEARCE, JUNIOR

DR. RICHARD MILLS PEARCE, JR., died on February 16, 1930, of heart disease. Born in Montreal on March 3, 1874, he received his early education at the Boston Latin School. Taking up the study of medicine, he entered the Harvard Medical School, from which he received his medical degree in 1897. After graduation there he came under the influence of Professor W. T. Councilman, and entered the department of pathology, where for a year he filled the position of instructor.

In 1900 Dr. Pearce was called to the University of Pennsylvania, becoming first demonstrator in pathology and, later, assistant professor of pathology. In 1903 he assumed the directorship of the Bender Hygienic Laboratory, in affiliation with the Albany (N. Y.) Medical College, in which latter institution he held the professorship of pathology and bacteriology. Five years later he became professor of pathology in the New York University and Bellevue Hospital Medical College, New York City. In 1910 he returned to the University of Pennsylvania, to fill the newly founded chair of research medicine, and thus became the first research professor in medicine in the United States. During the World War, Dr. Pearce gave valuable services with the American Red Cross in Washington as secretary of the Medical Advisory Committee and director of the Bureau of Foreign Medical Service, and later with the National Research Council as chairman of the division of medicine and related sciences. At the conclusion of the war he resumed his temporarily interrupted research work at the University of Pennsylvania. During three years of personal association with Dr. Pearce at the University of Pennsylvania, the present writer was able to appreciate his competence, talent and devotion both as teacher and as investigator.

In the course of his teaching and research, Dr. Pearce's own contributions to scientific knowledge in pathology were significant. He made real additions to the knowledge of cytotoxins at a period when that subject was in the formative stages of its growth, and, correcting current errors, diverted experiment into more accurate channels, through which distinct progress came to be made. With the aid of his pupils he carried through one of the comprehensive and substantial investigations of the pathology of the spleen, and embodied the results in a volume of permanent interest. In addition to these, which may be regarded as his major undertakings, he successfully investigated, either alone or with or through pupils, numerous other problems in pathology.

In 1920, Dr. Pearce entered upon activities through which he was soon to be known and respected in wider fields; he became associated with the Rockefeller Foundation, carrying out at first medical surveys in South American and other countries; in 1923, he became regularly attached to this foundation as director of the Division of Medical Education, which position he held up to the time of his death. The field was not new to Dr. Pearce; he had in 1912 delivered the Hitchcock Lectures at the University of California on the subject of "Research in Medicine,"[1] in which he had forcibly and lucidly discussed the historical and present-day problems of medical education and research. His association with the Rockefeller Foundation led Dr. Pearce to investigate personally the state of medical education in many parts of the world, and to devise means through which medical teaching and research might be advanced by judicious financial assistance. He made many visits to foreign countries, including a long stay in China, in order to assist in the organization of the Peiping Union Medical College, in addition to numerous visits

[1] Printed in "Medical Research and Education" by Richard M. Pearce and others. The Science Press, New York, 1913.

to medical institutions in the United States and in Canada. In the course of these studies, Dr. Pearce's constructive mind found out ways of modifying and improving existing conditions, and the warmth with which his suggestions were welcomed by the institutions under examination was shown by the frequency with which they were put into practice. It is not too much to say that Dr. Pearce's insight, high purpose, and tactful approach made his visits to educational institutions in many countries important events in their history. His services to them, conceived broadly as educational, were something apart from any material aid which he might bring them, although it sometimes happened, of course, that the developments which he foresaw could only be brought to fruition through financial aid.

There can hardly be a doubt that an essential part of Dr. Pearce's success in perceiving ways of extending and improving facilities for medical education and research arose from his own dominant interest in medical research and his personal contributions to medical knowledge. During the whole of Dr. Pearce's laboratory career, which extended from 1900 to 1923, or more than twenty years, he was engaged himself, or with pupils, in teaching and in conducting medical research. This experience was of inestimable value to Dr. Pearce in his subsequent highly onerous and influential position as an officer of the Rockefeller Foundation, and to it may be traced those courageous, comprehensive projects in the enlarging of facilities for instruction and research in many places in the United States and Europe.

Dr. Pearce possessed a winning personality which brought him many friends and admirers. The nature of his educational activities in the later years gave an almost world-wide scope for the operation of his personal gifts. His heart was deeply immersed in these activities, and he felt the burden of the critical position which he came to occupy because of the declared purpose of the Rockefeller Foundation to contribute toward the improvement of medical teaching and research on a world-wide scale, an undertaking vast and intricate in nature. But it is doubtful whether in his heart of hearts the laboratory ever ceased to beckon to and allure him. This secret, if secret it be, was known to at least a few of his intimate professional friends. Possessed as Dr. Pearce was of clear perception and rare courage, he must have repeatedly put these longings behind him because of a conviction that perhaps after all he might serve an even wider purpose and accomplish greater good by making possible higher levels of education, and by providing better means of research to countless students in time to come in the many institutions to which financial aid could be brought through his efforts.

The death of Dr. Pearce means the loss of one who had been a notable teacher, investigator and finally supporter of medical education and research; but it is certain that the benefits of his effective labors will continue to be widely felt for very many years.

SIMON FLEXNER

THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK

SCIENTIFIC EVENTS

AN AFRICAN MAMMAL HALL FOR THE MUSEUM OF THE CALIFORNIA ACADEMY OF SCIENCES

MR. LESLIE SIMSON, retired mining engineer and capitalist, of Berkeley, California, has sailed from New York for Mombasa, British East Africa, for the purpose of securing specimens of animals for habitat groups of African big-game animals for the California Academy of Sciences. Mr. Simson expects to collect the animals necessary for forty to fifty habitat groups, which will be installed in the Leslie Simson African Mammal Hall, which will constitute one of the most important units of the east wing of the academy's museum in Golden Gate Park, San Francisco. Construction work on the new wing will begin this summer, and it is expected that the building will be completed in 1931. The plans provide a hall or halls ample for housing and proper display of fifty or more habitat groups of large size similar to those in the present California Mammal Hall in the museum.

Mr. Simson lived in Africa for thirty-one years, associated with John Hays Hammond in mining operations. During his long residence there he did a great deal of hunting and became very familiar with the habits and the habitats of practically all the species of big-game animals of Africa.

Mr. Simson will at first make his headquarters at Nairobi, Kenya; later he will go to other big-game centers until he has secured a good representation of the species of big-game animals of Africa.

Upon his arrival at Nairobi he will begin his hunting at once, and he expects his first shipments of animals to reach San Francisco not later than next September. It is Mr. Simson's desire to provide the California Academy of Sciences with a series of habitat groups of African mammals second to none in America. His offer of materials and money to the academy should make this possible. He estimates that it will take about three years for him and his assistants to do the collecting.

THE SECOND BERMUDA OCEANOGRAPHIC EXPEDITION

THE thirteenth expedition of the Department of Tropical Research of the New York Zoological Society under the directorship of Dr. William Beebe will leave for Nonsuch Island, Bermuda, on April 9.

The work this season will be a continuation of that begun last year—a detailed study of the fishes of shallow water, mid-depths and down to a mile in the open ocean. The tug *Gladisfen* has been rechartered for the season, and the deep-sea work will be confined to the submarine, cylindrical area selected last year. This zone is five miles south of Nonsuch, eight miles in diameter, and extends from a half mile to a mile beneath the surface. Within this watery space five hundred and twenty-eight nets were drawn in 1929, and it is hoped to increase this to one thousand during the present season.

As an example of the unexpected wealth of deep-sea fish life, the family Myctophidae may be cited. In 1929 there were captured in this sharply delimited area fifty-one per cent. of all the species of Myctophids or Lantern Fishes known from the seven seas, and eighty-seven per cent. of those hitherto known from the north and south Atlantic Oceans. These were distributed among four thousand, one hundred and sixty-one individuals.

Besides the intensive trawling with meter nets as last year, some bottom dredging with the seven-ton *Arcturus* winch will be done. With the aid of the same winch and with the spherical, steel diving chamber planned and financed by himself, Mr. Otis Barton will attempt to descend to a depth of a quarter of a mile. One of the chief objects of the expedition is to determine the continuity of benthontic fish life which connects the mid-water zone of one hundred fathoms with that of the ocean's floor two miles down. It is hoped that Dr. Harvey will continue his studies of luminescence in fish and crustaceans, and that Dr. Conklin will work on the early development of Amphioxus. Dr. Gregory and Dr. Fish will both spend some time at the station. As last year, the present expedition is made possible by the generosity of two members of the board of managers of the Zoological Society, Mr. Harrison Williams and Mr. Mortimer L. Schiff.

Besides the regular staff of the department, Beebe, Tee-Van and Hollister, a number of young college men will be taken, who will help in general activities and carry on special lines of research. Among these are S. Thomas, J. Cannon, J. Guernsey, P. Crouch, J. H. Conneny, J. Potter, W. C. Buhlman and P. Jackson. Three artists who did most excellent work last year at the station—Helen Tee-Van, Elsa Bostelmann and Llewellyn Miller—will spend part of this season in the field.

THE MEDAL AWARDS OF THE AMERICAN GEOGRAPHICAL SOCIETY

AN announcement of the medal awards of the American Geographical Society for 1929 and 1930 appears in the April number of the *Geographical Review*. These awards have not been made for several years "in order that accumulated funds would make it possible to award them to distinguished persons of different nationality in a given year." The list of awards with citations follows.

Award of the Cullum geographical medal for 1929 has been made to Hugh Robert Mill, Jean Brunhes, Alfred Hettner, Jules de Schokalsky. The Cullum geographical medal is awarded from time to time to those "who distinguish themselves by geographical discoveries, or in the advancement of geographical science." The last awards were made in 1925.

HUGH ROBERT MILL. Geography is under a heavy debt to Dr. Mill for researches in his special field and writings on a wide range of geographical topics, all resting on a sound physical basis. As he himself has expressed it, his researches have been largely directed towards the discovery of the control exerted by the various forms of the earth's solid crust upon the fluid envelopes. Dr. Mill was director of the British Rainfall Organization and editor of *British Rainfall* and *Symons's Meteorological Magazine* for many years. He has filled various offices in the Royal Meteorological Society and the Royal Geographical Society and has served on the International Council for the Study of the Sea. Educational geography has profited from his writings; and he has always had a special interest in the polar regions, particularly the Antarctic. He is chairman of the board of directors of the Captain Scott Polar Research Institute.

JEAN BRUNHES. The name of Jean Brunhes, professor of geography at the Collège de France, is one with "La géographie humaine," one of the outstanding geographical works of our time. Translated into English it has had a profound effect upon American geographical teaching and point of view. Professor Brunhes is also known for his volume on the human geography of France contributed to the "Histoire de la nation française" and his collaboration with Camille Vallaux on the "Géographie de l'histoire." The government of France has sought his advice and assistance in studies and recommendations relating to the French colonies in the Far East and in Africa.

ALFRED HETTNER. As professor of geography in the University of Heidelberg, Dr. Hettner has exercised great influence on the development of geography in Germany, especially regional geography. In this he has been particularly aided by the *Geographische Zeitschrift*, one of the leading critical geographical journals, of which he is founder and editor. As a young man Hettner carried out important explorations in South America. "Russland" and the "Grundzüge der Ländeskunde," to mention two of his numerous writings, are model works of their kind, and a special word must be reserved for his book on methodology.

JULES DE SCHOKALSKY. Dr. Schokalsky is professor

of oceanography in the Leningrad State University, president of the Russian Geographical Society and corresponding member (meteorology) of the Russian Academy of Sciences. His voluminous writings have been mainly in the fields of oceanography, hydrography and cartography. In the last named he compiled what is now the standard general map of Russia, a map in sixteen sheets on the scale 1:2,000,000. In 1917 he published a treatise on oceanography which is the crystallization of his previous work along these lines. He has recently undertaken a comprehensive survey of the Black Sea.

Award of the Charles P. Daly gold medal for 1929 has been made to Filippo De Filippi and Émile Félix Gautier. The Charles P. Daly gold medal is awarded from time to time "for valuable or distinguished geographical services or labors." The last award was made in 1927.

CAV. FILIPPO DE FILIPPI, secretary-general of the International Geographical Union, has done distinguished work in exploration. He accompanied the Duke of the Abruzzi on expeditions to Mt. St. Elias, in the Karakorum, and to Mt. Ruwenzori. Realizing the "variety and the importance of the problems as yet unsolved" in the Karakorum region, he organized an expedition of his own in 1913 and by the aid of a group of specialists carried out some remarkable work in geology, physical geography including glaciology, and human geography in the mountains and plateaus between the Vale of Kashmir and Chinese Turkestan.

ÉMILE FÉLIX GAUTIER. For a quarter of a century Professor Gautier, of the University of Algiers, has devoted himself to geographical investigations in northern Africa and the Sahara, on which regions he is a recognized authority. His writings, distinguished by characteristic ease and originality, reveal the intimacy of his knowledge in his chosen sphere.

CELEBRATION OF FIFTY YEARS OF ENGINEERING PROGRESS BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE Fiftieth Anniversary of The American Society of Mechanical Engineers will be celebrated in April in Washington, in Hoboken and in New York. The leading scientific and engineering societies and educational institutions throughout the world have been invited to send two delegates each to the celebration. Similar invitations have been extended to the leading trade associations and trade schools of the United States.

The celebration will open on April 5 in New York, where the delegates, members and guests will register at the United Engineering Societies Building. This will be followed by the unveiling of a tablet in the lobby of the building commemorative of the anniversary, and then the whole party will be taken to the offices of *The American Machinist,* a program being given that depicts the preliminary organization meeting on February 16, 1880.

The anniversary program will be continued at Stevens Institute at Hoboken, N. J., commemorating the organization meeting in the auditorium of the institute with a pageant of engineering progress which has been written by Dr. George Pierce Baker, of the department of drama, Yale University, and which will be presented by the institute under his direction.

At 7:30 p. m. will be given at the Hotel Roosevelt in New York a welcoming dinner under the auspices of the metropolitan section of the society. The toastmaster is Charles M. Schwab, an honorary member and past-president of the society. An address of welcome will be given by the president of the society, Charles M. Piez. There will be two other speakers—James H. McGraw, chairman of the board of the McGraw-Hill Publishing Company, who will represent the engineering press, and Robert I. Rees, president of the Society for the Promotion of Engineering Education, who will represent the field of engineering education.

On Sunday morning at eleven o'clock there will be commemorative services at the Cathedral of St. John the Divine in New York City. During that afternoon and evening departure will be taken for Washington, D. C.

In Washington, April 7, on Monday morning at eleven o'clock in the National Council Chamber of the U. S. Chamber of Commerce Building will be held the welcoming assembly. Addresses will be given by a representative of the government of the United States and by the president of the society, Charles Piez. There then will follow brief addresses by a delegate from each country in behalf of all the delegates from his country; by the presidents of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the American Institute of Electrical Engineers. Palmer C. Ricketts, president of Rensselaer Polytechnic Institute, will speak in behalf of American engineering educational institutions; William Butterworth, president of the Chamber of Commerce of the United States, in behalf of business organizations of the United States, and then a delegate in behalf of various American scientific and professional societies.

In the afternoon there will be a session on the Influence of Engineering upon Civilization, when seven of the sixteen national papers covering the humanistic aspects of engineering will be summarized in short addresses. This will be followed by a reception at the White House, while in the evening a reception will be given by the officers and council of the society.

On Tuesday the second part of the session on the

Influence of Engineering upon Civilization will be held when the remaining nine national monographs will be presented. There will be an address summarizing "Fifty Years of Mechanical Engineering in the United States." At noon a luncheon will be given in honor of the founders of the society and this will be followed by the ceremonies attendant upon the presentation of medals of distinction.

Fiftieth Anniversary Medals will be conferred upon the sixteen men who present the monographs. The formal presentation will be made in each case by the Ambassador in Washington of the country sending the delegate. This occasion has been deemed unusually appropriate for the presentation of four other medals—the American Society of Mechanical Engineers, the Gantt, the Melville and the Guggenheim, to William Leroy Emmet, Fred J. Miller, Joseph Wickersham Roe and Orville Wright, respectively. This particular part of the exercises will be in charge of Dr. Arthur M. Greene, Jr., dean of engineering at Princeton University.

At a formal dinner on Tuesday evening at which Dr. W. F. Durand, past-president of the society, will preside as toastmaster, there will be addresses by the president of The American Society of Mechanical Engineers, and by Dr. Robert A. Millikan, past-president of the American Association for the Advancement of Science. There will also be an address by a distinguished American that may include, from an international view-point, an evaluation of the influence of engineering in promoting international amity and upon the progress of mankind.

On Wednesday, April 9, the delegates will visit points of interest in Washington and vicinity.

The announcement and first presentation will be made of the Herbert Hoover Medal by the Hoover Medal Board representing the A. S. C. E., the A. I. M. E., the A. S. M. E. and the A. I. E. E.

SCIENTIFIC NOTES AND NEWS

MR. JOHN W. DAVIS, formerly United States Ambassador to Great Britain, will preside at a dinner of the American Philosophical Society to be held in New York on April 2 under the auspices of the New York members of the society. The speakers will be Sir Robert Falconer, president of the University of Toronto; Dr. Livingston Farrand, president of Cornell University; Roland S. Morris, formerly ambassador to Japan.

PROFESSOR ALBERT A. MICHELSON has returned to the University of Chicago, his health much improved after two months spent in Bermuda. He intends to remain at Chicago for several months, working in the Ryerson Physical Laboratory, and then plans to go to California to continue his measurements of the velocity of light in a mile-long vacuum tube.

DR. KARL LANDSTEINER, a member of the Rockefeller Institute for Medical Research, New York, was awarded on March 14, the anniversary of Ehrlich's birth, the Paul Ehrlich gold medal of the Paul Ehrlich Foundation of Frankfort-on-the-Main, in recognition of his work on human blood groups and his hapten theory of immunity.

DR. ROBERT DOERR, professor of hygiene at Basle, has been awarded the Josef Schneider gold medal by the University of Wurzburg.

THE *Journal* of the American Medical Association reports that Professor Carlo Comba, director of the pediatric clinic of Florence, was the recipient of special honors on the twenty-fifth anniversary of his teaching activities. Professor Fiore presented his former teacher with a volume of scientific articles published for the occasion. Professor Comba has given the university 100,000 lire ($5,263) for a research fellowship in pediatrics.

WE learn from *Nature* that at a meeting of the Royal Society of Edinburgh, held on March 3, the following were elected fellows: Professor William Annan, Edinburgh; Mr. D. R. R. Burt, Colombo; Lieutenant-Colonel John Cunningham, Edinburgh; Lieutenant-Colonel L. M. Davies, Edinburgh; Dr. A. E. M. Geddes, Aberdeen; Dr. Douglas Guthrie, Edinburgh; Sir Thomas Holland, Edinburgh; Dr. David Jack, St. Andrews; Dr. S. G. Jones, Glasgow; Professor P. S. Lelean, Edinburgh; Dr. J. W. Low, Bristol; Dr. A. C. M'Candlish, Sorbie; Mr. W. C. Miller, Edinburgh; Dr. J. M. W. Morison, Edinburgh; Mr. James Morton, Edinburgh; Professor Wm. Oliver, Edinburgh; Principal G. F. O'Riordan, London; Mr. A. W. Ritchie, Edinburgh; Dr. David Russell, Leven; Dr. F. W. Sansome, London; Mr. E. C. Shankland, London; Dr. R. H. Slater, Edinburgh; Mr. J. W. Struthers, Edinburgh; Professor C. W. Stump, Sydney; Dr. J. D. Sutherland, Edinburgh; Dr. C. I. B. Voge, Edinburgh, and Dr. A. C. White, Beckenham.

SIR THOMAS H. HOLLAND, vice-chancellor of the University of Edinburgh, has been awarded the Gold Medal of the Institution of Mining and Metallurgy "in recognition of his eminent services to geological science and to the mineral industries during his tenure of high public appointments—notably those of director of the Geological Survey of India and of rector of the Imperial College of Science and Tech-

nology—and of his researches and publications upon the mineral resources of the British Empire and their relationship to national and international problems."

DR. WILLIAM J. ROBBINS, professor of botany in the University of Missouri, who has been on leave of absence working for the Rockefeller Foundation, Paris, has been appointed dean of the graduate faculty to succeed Dr. Walter Miller.

DR. F. L. STEVENS, professor of plant pathology of the University of Illinois, has accepted the first year incumbency of the newly established Baker professorship in the College of Agriculture, University of the Philippines. He will leave the University of Illinois on May 26, going directly to Manila. After the close of his work there, he plans to collect in the neighborhood of the Malay Archipelago and of the South Seas, especially in Siam, Sumatra, Java, Bali, Rarotonga and Tahiti, returning to the University of Illinois in September, 1931.

DR. J. W. SHIPLEY, associate professor of chemistry in the University of Manitoba, has been appointed professor of chemistry and head of the department in the University of Alberta. The appointment followed the retirement, due to illness, of Dr. A. L. F. Lehmann, who has been in charge of the department since the organization of the university in 1907.

DR. WILLARD WYLIE SPENCER, a graduate of Yale University, has been appointed head of the department of philosophy and logic of Miami University. Dr. Spencer is to fill the position left vacant by the resignation of Dr. Daniel Robinson last year and at present held by Dr. E. E. Powell as acting head of the department.

MR. J. B. S. HALDANE has been elected Fullerian professor of physiology at the Royal Institution, London, in succession to Mr. Julian S. Huxley.

DR. M. A. RAINES has resigned his position with Carl Zeiss, Inc., New York City, to accept appointment as associate professor of botany at Howard University, Washington, D. C.

THE resignation is announced of Dr. Roger Griswold Perkins, professor of bacteriology and preventive medicine and head of the department of bacteriology and hygiene of the School of Medicine of Western Reserve University. Dr. Perkins desires to be liberated from university duties so that he may have more time for special studies. He will live at Wakefield, Rhode Island.

PROFESSOR C. W. WOODWORTH has leave of absence from the University of California in order to carry on work for the California Spray-Chemical Corporation.

L. W. STEPHENSON has resumed his work as chief of the section of coastal plain investigations in the U. S. Geological Survey after a four-month furlough for field work in Venezuela.

AN expedition led by Dr. Robert F. Griggs will be sent to Alaska by the National Geographic Society during the coming summer to study the changes caused by volcanic eruptions. The party will work over the territory around Katmai Volcano and the Valley of Ten Thousand Smokes, which Dr. Griggs discovered while leading the society's expedition of 1916.

A PARTY of scientific men and sportsmen has left New York City for Miami to join the new *Nourmahal,* Mr. Vincent Astor's 2,900-ton motor yacht, bound for Indefatigable Island, one of the least known of the Galapagos group. They intend to cut their way to the interior of the island, to which no exploring expeditions have penetrated, and expect to find new species of animal and plant life. Accompanying Mr. Astor will be Dr. Eugene H. Pool, of the New York Hospital; Clarence L. Hay, of the American Museum of Natural History; Kermit Roosevelt, C. Suydam Cutting, Robert D. Huntington, Dr. James P. Chapin, ornithologist, of the American Museum of Natural History; Dr. Henry K. Svenson, of the Brooklyn Botanical Garden; Elwin R. Sanborn, photographer, of the New York Zoological Society; Wilfred S. Bronson, artist, and Dr. Charles H. Townsend, director of the New York Aquarium, who will be scientific director of the expedition. The trip originally was planned as a pleasure cruise. Then, interested in the peculiar natural characteristics of the Galapagos Islands, Mr. Astor invited Dr. Townsend to recruit a group of scientific men for the expedition.

DR. WILLIAM J. MAYO, of the Mayo Foundation, will deliver the first Stuart McGuire Lecture at the Medical College of Virginia, Richmond, on May 12. This lectureship has been established in recognition of Dr. Stuart McGuire's presidency of the college, from which he retired in 1925. The general public as well as the profession will be invited to attend.

COLONEL BAILEY K. ASHFORD, of the University of Porto Rico, who has been chosen by the Association of Military Surgeons of the United States as the lecturer of the Kober Foundation for 1930, delivered a lecture on "Significance of Mycology in Tropical Medicine" on March 28 in Washington.

PROFESSOR L. CHARLES RAIFORD, professor of organic chemistry, Iowa State University, has been appointed visiting professor for the forthcoming summer session of Western Reserve University. Professor Raiford will offer two courses of lectures: the

one on "Organic Nitrogen Derivatives," the other one on "Type Reactions in Organic Chemistry."

DR. A. B. STOUT, director of laboratories, New York Botanic Garden, lectured on March 14 at the University of Pennsylvania on "Sterilities in Plants." On March 15 he addressed the Botanical Society of Pennsylvania on the subject of "Day Lilies."

DR. CHARLES R. STOCKARD, professor of anatomy at Cornell University Medical School, New York City, will deliver the Lane Medical Lectures for the year 1930 at the Stanford University Medical School, San Francisco, from May 5 to 9. The subjects of the separate lectures are: "Medical and Biological Aspects of Constitution"; "Germinal Constitution"; "Developmental Constitution"; "The Interplay of Inheritance and Environment in Constitution," and "Postnatal Reactions and Periodic Changes in Constitution." Dr. Stockard will also give a lecture at Stanford University on May 7 on "Structural Types in Animals and Men."

PROFESSOR CASWELL GRAVE, head of the department of zoology at Washington University, St. Louis, gave on March 14 and 15 the following lectures at Oberlin College: "Structural Mechanisms of Ascidian Larvae which may be Involved in the Control of Metamorphic Change" and "Acceleration of Processes Underlying Metamorphosis of Ascidian Larvae."

DR. FRANK B. JEWETT, vice-president of the American Telephone and Telegraph Company, gave the third Aldred Lecture in the present series at the Massachusetts Institute of Technology on February 14. He spoke on "What Industry Expects of the Graduate." The fourth lecture was given on March 14 by Major W. C. Gotshall, of New York City, on "Reflections of an Engineering Experience."

DR. KARL MEYER, director of the Hooper Foundation for Medical Research of the University of California, will give a series of lectures at the University of Washington next July, as one of a group of medical men contributing to a short course for practicing physicians of the State of Washington.

THE Honor Society of Gamma Sigma Delta and the seminars for agronomy and for botany at the Kansas State Agricultural College were addressed by Dr. Edgar T. Wherry on March 11, 12 and 13.

LECTURES under the auspices of local chapters of Delta Omega, the honorary public health society, were given in March at the Massachusetts Institute of Technology and the Yale School of Medicine. At the third annual Delta Omega lecture at the Massachusetts Institute on March 4, Dr. C. C. Young, of the Michigan State Department of Health, national president of the society, spoke on "The Trend in the Development of Public Health Laboratories." The speaker at the second annual Delta Omega lecture at the Yale School of Medicine on March 14 was Dr. George H. Bigelow, State Commissioner of Public Health of Massachusetts, who discussed the official program for cancer control in his state.

DR. A. LANDÉ, of the University of Tübingen, now visiting professor of physics at the Ohio State University, gave a series of lectures on "Wave Mechanics" at the University of Kentucky on February 27 and 28.

PROFESSOR JULES DUESBERG, professor of anatomy and rector of the University of Liége, has accepted appointment as visiting professor from Belgium to the United States under the auspices of the C. R. B. Educational Foundation, Inc., 42 Broadway, New York. Professor Duesberg will lecture in English on biological subjects during January, February and March, 1931. During the war Professor Duesberg was connected with the Johns Hopkins Medical School.

PROFESSOR E. W. HEY GROVES, of the University of Bristol, delivered the Harveian Lecture before the Harveian Society of London on March 13. His lecture was entitled "Should Medicine be a Mendicant?"

PROFESSOR G. ELLIOT SMITH gave a lecture on "The Human Brain" at the Royal Society of Arts, London, on March 12.

AT the fourteenth annual meeting of the Pacific Division of the American Association for the Advancement of Science, to be held at Eugene, Oregon, from June 18 to 21, the Thursday evening address will be presented by Professor A. E. Douglass, of the University of Arizona. Dr. Douglass will discuss tree rings in relation to the history and ethnology of the southwest. His lecture will be illustrated by slides and motion pictures.

THE Pacific Section of the Botanical Society of America will hold its regular annual meeting in conjunction with the Pacific Division at the University of Oregon. Any botanist not a member of this division but who can attend these meetings is cordially invited to do so. Those desiring to give papers should notify the secretary of the botanical section, E. T. Bartholomew, Citrus Experiment Station, Riverside, California, not later than May 1, giving the title of the paper, the length of presentation time, and stating whether the use of a lantern is desired.

THE Ohio Academy of Science will hold its fortieth annual meeting at Ohio State University on Friday and Saturday, April 18 and 19, under the

presidency of Dr. F. C. Waite, of Western Reserve University. In general the program will follow that of other years, namely, a business session followed by a general scientific session in the forenoons, and sectional meetings in the afternoons, with a banquet followed by the presidential address on Friday evening. One interesting feature will be an illustrated lecture on "The Mound Builders—the First Ohioans," by Director H. C. Shetrone, followed by a personally conducted tour of the museum.

THE first meeting of the American Association of Physical Anthropologists will be held from April 17 to 19, at the University of Virginia, Charlottesville, coincidentally with the meeting held by the American Association of Anatomists. A program will be devoted to the subjects of mutual interest to the two societies. Detailed information concerning the objects and scope of the organization may be obtained from the chairman, Dr. Aleš Hrdlička, of the U. S. National Museum.

THE eighteenth annual meeting of the Eugenics Research Association will be held on Saturday morning (10:30), May 17, in New York City at the McAlpin Hotel. The day will be spent in eugenical programs, the morning being devoted to the Eugenics Research Association, the afternoon to the American Eugenics Society and the evening to the eugenics dinner, which will be the occasion for two short addresses on eugenical problems.

THE one hundred and sixty-third regular meeting of the American Physical Society will be held in Washington, on April 25 and 26. The Friday sessions will be held at the Bureau of Standards and the Saturday sessions at the National Academy Building. Those working on problems in "applied" physics are especially invited to report their researches at this meeting. It is planned to have at least one of the regular sessions on Friday devoted entirely to such papers.

THE date of the forthcoming congress of the International Society for Microbiology has been altered by the Central Committee in Paris to July 20 to 25.

THE fortieth anniversary of the Ecole de Psychologie of Paris, founded by Dr. Bérillon, was recently celebrated at a meeting attended by Professors Richet, Pierre Janet, Roux, Menetrier and Marcel Labbé.

THE will of the late William H. Nichols, chairman of the Board of the Allied Chemical and Dye Corporation, bequeaths $1,000,000 to public purposes. Half of the residuary estate is left to New York University for the maintenance of the Nichols Chemical Laboratory, which Mr. Nichols gave to the institution in 1927. He served as acting chancellor of the university last spring and fall during the illness of Chancellor Brown. It is requested that the bequest be used to keep the laboratory "at all times in good order and repair and well equipped." The largest institutional legacy is $250,000 to the Polytechnic Institute of Brooklyn. Mr. Nichols attended that school for three years in his youth and was vice-chairman of its board. The American Chemical Society and the American Society for the Control of Cancer each receive $50,000.

PRINCETON UNIVERSITY will receive a trust fund of $1,165,212, representing one half of the residuary estate of William Burhans Isham. The university will also receive a remainder interest amounting to $95,139 in the residence of the testator and a chest of silver valued at $2,500.

BEQUESTS received by De Pauw University during the past two weeks include a legacy of $200,000 for a chair of philosophy from James Nelson, of Indianapolis; the bulk of the estate of John H. Harrison, of Danville, Illinois, valued at between one and two million dollars, and approximately $150,000 from the estate of Marion B. Stultz, late trustee of the university, who named De Pauw residuary legatee in his will after giving his wife a life interest in his estate.

THE American Museum of Natural History receives $557,361 under the will of Frederick G. Voss. The bequest is to be used in the further development of research in anthropology and archeology.

THE University of London has received a bequest by the late Lady Durning-Lawrence of £10,000, for the equipment of the physical and electrical chemistry laboratory at University College.

FORMER SENATOR GEORGE WHARTON PEPPER will head a committee of the Benjamin Franklin Memorial, Incorporated, in a campaign to raise a fund of $5,000,000 for the erection of a science museum and memorial to Franklin on the Parkway, Philadelphia.

THE House has passed a bill (H. J. Res. 210) authorizing an appropriation of $15,000 for the expenses of official delegates of the United States to the World's Fourth Poultry Congress, to be held in England from July 22 to 30. Funds had previously been appropriated for a United States Government exhibit. The Office of Motion Pictures of the Extension Service of the U. S. Department of Agriculture is making a series of eight poultry motion-picture films for the exposition. Two of the eight have been finished though not yet released—The Turkey Business and Breeding for More and Bigger Eggs; three are in production—The Egg Marketing of the United States, The Poultry Marketing Industry of the

United States and Cooperative Marketing—Eggs and Poultry, and films on which scenario work has been done, but on which production has not started, are Brooding and Rearing Chicks, Eradication of Poultry Parasites and Rearing Chicks in Confinement.

IT is stated in *Nature* that the International Union for Pure and Applied Chemistry has now been reconstituted and brings in the German chemical societies under mutually acceptable conditions. Before this could be accomplished, it was necessary for three of the leading German chemical societies to form a joint committee for international occasions. This Verband Deutscher Chemischer Vereine has been able to negotiate with the Union Internationale de la Chimie Pure et Appliquée. The new constitution and statutes are given in an article by Professor Haber, president of the Verband D. C. V. in the *Zeitschrift für Angewandte Chemie*. The new title is to be Union Internationale de Chimie, omitting the words pure and applied. The new statutes were agreed upon at Scheveningen in June, 1929. German adhesion to the reconstituted union is subject to the understanding that in its new constitution the International Research Council will not hinder the autonomy and free development of the union.

THE London *Times* reports that the British Association for the Advancement of Science has been summoned at Bromley (Kent) for the non-payment of rates on Downe House, Charles Darwin's old home. Mr. Weller, who appeared for the Bromley Rural District Council, said that points of law were involved and counsel had been instructed on both sides. The case was adjourned. Downe House was presented to the British Association by Mr. Buckston Browne as a national memorial to the great naturalist, and was opened last June by Sir Arthur Keith.

ARRANGEMENTS are being considered by which graduate students in meteorology at the Massachusetts Institute of Technology may be sent to the University of California Scripps Institution of Oceanography at La Jolla, California, to acquire additional knowledge of the subject.

THE Frederick H. Rawson-Field Museum Ethnological Expedition to West Africa has completed its work in Angola (Portuguese West Africa) and Nigeria (British West Africa), and is returning with extensive collections. The expedition, under the leadership of Assistant Curator W. D. Hambly, has collected large amounts both of exhibition and study material representing many tribes of which little scientific knowledge had previously been available. In addition to collecting artifacts, the expedition made still and motion pictures of natives engaged in many occupations, took dictaphone records of their languages and collected various other data for scientific reports. The Chancellor-Stuart-Field Museum Expedition to the South Pacific has also returned with important collections for the department of zoology. The expedition worked in Australia and New Zealand as well as in the Dutch East Indies. Philip M. Chancellor, of Santa Barbara, California, was both sponsor and leader of the expedition. Associated with him as coleader was Norton Stuart, naturalist, also of Santa Barbara.

THE British government has decided to more than double the allocation of funds for forestry extensions for the second period of ten years under the national afforestation scheme. For the first ten years a sum of £3,500,000 was allotted, with the help of which an area of 164,000 acres will have been planted by the end of this year. In addition to this, some 70,000 acres have been planted by private landowners and local authorities. The planting of this area has meant the employment of about 3,500 men in winter and 2,500 in summer. Nearly 700 small holdings have been established providing all-the-year-round work for that number of families. These family holdings also mean the growing up of a class of skilled forest workers. Forest work for 150 days in the year is guaranteed, while for the remainder the forester is allowed to work on his own 10-acre holding.

THE Radium Commission, London, announces, according to the *Journal* of the American Medical Association, that the 4-gm "bomb" has been received from Belgium and, after being measured and tested in the National Physical Laboratory, it was handed over to the Westminster Hospital, where arrangements for its installation and manipulation and the treatment of patients had already been made. If at the end of three months the National Radium Trust decides to purchase the radium composing the bomb, it will be entrusted to the hospital for a further period of three years at a rental of $2,000 a year, and the hospital will maintain a continuous day and night service with the bomb, in the pursuit of objectives prescribed by the commission. The commission has decided to recognize as national radium centers only such places as possess medical schools with complete clinical courses and facilities for giving instruction in radium therapy. The commission believes that the need for trained workers is even more urgent than the supply of radium itself. It will initiate all negotiations for the constitution and equipment of national radium centers through the medical faculties of the local universities concerned. When the respective claims and requirements of the

various radium centers have been considered and assessed by the commission, the allocation of national supplies of radium will be commenced. Orders have already been placed by the trust for 10 gm exclusive of the 4-gm bomb, and it is anticipated that the whole of this should be available before the autumn of 1930. It has been decided to install a radon plant at the National Physical Laboratory for the purpose of supplying (under proper safeguards) radon to hospitals or other institutions which otherwise could receive no direct assistance from the commission for radium therapy.

DISCUSSION

ENVELOPING MEMBRANES OF ECHINODERM OVA

THE fertilization membrane of Echinoderm ova has been made a subject of discussion in two recent communications to SCIENCE, one by A. R. Moore, "The Function of the Fertilization Membrane in the Development of the Larva of the Sea Urchin,"[1] and the other by E. E. Just, "The 'Fertilization' Membrane of Echinid Ova."[2]

The former is a statement of certain facts from which a rather sweeping conclusion is drawn, while the second cites observations on one kind of ovum to refute the conclusion of the former dealing with another kind of ovum.

Moore, using the ova of *Strongylocentrotus purpuratus,* found that eggs treated with urea and subsequently fertilized form no fertilization membranes, and when segmentation sets in the blastomeres fall apart. He concluded that membrane formation (by which he evidently means the fertilization membrane) is of fundamental importance to the development of organisms consisting of closely associated groups of cells. He should have restricted this conclusion to urea-treated Strongylocentrotus eggs.

It is to be deplored that Just makes no mention of the species on which he bases his conclusions. Presumably he has reference to the Woods Hole Echinids *Arbacia punctulata* and *Echinarachnius parma.* In addition to using data of his own on the removal of the fertilization membrane Just gives credit, albeit dubiously, to the micro-dissection method by means of which the vitelline membrane has been removed from the uninseminated eggs of both these species.[3] Such eggs, when subsequently fertilized, segment and develop into normal embryos with no fertilization membranes.

Hence, both investigators are correct if only they had restricted their divergent conclusions to the particular species with which they worked; namely, when the Strongylocentrotus ovum is divested of its fertilization membrane by means of urea its blastomeres do not hold together to develop into an embryo, while the Arbacia and Echinarachnius eggs, on the other hand, are fully capable of normal development without fertilization membranes.

I have not worked with the Strongylocentrotus egg, but from Moore's observation I judge that it closely resembles the Woods Hole Asterias egg in regard to the cohesive properties of the blastomeres. In the Asterias egg the early blastomeres are loosely distributed within the fertilization membrane and only by careful observation can one detect a delicate, secondary membrane, investing the outer borders of the blastomeres and extending between them. This membrane, which develops on the surface of the egg several minutes after the fertilization membrane is lifted off, is too weak to hold the blastomeres together so that they would fall apart if it were not for the externally investing fertilization membrane. Moreover, this secondary membrane is formed only when a bivalent electrolyte (Ca or Mg) is present in the surrounding medium.

In the Arbacia and Echinarachnius egg a similar secondary membrane is formed, the so-called hyaline plasma layer, and it is strong enough to hold the blastomeres firmly together without the aid of the fertilization mebrane. This secondary membrane can be torn with micro-needles, in which case the blastomeres fall apart.[4] This and the fertilization membrane constitute the anatomical structures (quite apart from the true plasma membrane of each individual cell) which Moore rightly concludes are necessary to permit normal development by keeping the cells closely associated.

ROBERT CHAMBERS

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THE ELECTRON AND RADIATION

THE electron has been shown[1] in several ways by me to possess certain fundamental properties. It is of course desirable that this result should be obtained in as many ways as possible, and one more will therefore be given here.

Consider a closed chamber with perfectly reflecting walls whose total mass is infinitely large so that they may withstand any pressure. Suppose that the chamber contains a single free electron, and a par-

[1] 70: 360, October 11, 1929.
[2] 71: 243, February 28, 1930.
[3] Chambers, *Biol. Bul.,* 41: 318, 1921.
[4] *Anat. Rec.,* 25: 121, 1923.
[1] *Phil. Mag.,* 7: 493, 1929; SCIENCE, 70 (1820): 479, 1929.

ticle of matter to insure that the chamber contains black body radiation. Further suppose that an alternating electric field is applied to the chamber so that the electron moves to and fro, but without touching the walls. If the electron is perfectly reflecting it will perform work upon the radiation, and the temperature will accordingly continually increase till the radiant energy per cc is infinite. But such a concentration of energy, we may take it, is impossible. The electron can not therefore be perfectly reflecting, or it absorbs besides reflects radiant energy. Now a continual increase in its internal energy through absorption of radiation on account of its motion is not permissible, since in that case its internal energy would ultimately become infinitely large, and hence it is periodically converted into some other form. This can not be radiation produced by acceleration, since the energy required for this is derived from the kinetic energy of the electron, or the energy of the applied field. The internal energy must therefore be converted directly into radiation, and hence the electron may radiate in two entirely different ways.

But even under these circumstances the applied field will perform work upon the electron, for the energy converted into radiation through acceleration may be varied through the applied field, and this work ultimately appears as radiation. Thus the density of the radiation may be made infinitely large, which we have seen is impossible. It follows, therefore, that ultimately the applied field should have no effect on the electron, or that its field decreases till zero. Since the temperature under these conditions will be very large, causing a large absorption of radiant energy by the electron, its average amount of internal energy will in consequence be very large. Thus in a general way the external field of an electron decreases with increase of its internal energy.

We might also in the beginning have supposed that the force on the electron decreases with increase of density of radiation. Since the density would nevertheless become infinite, we must suppose that the force becomes zero for a finite density. This is possible only if the electron undergoes a change, which naturally involves a change in internal energy, and so on.

R. D. KLEEMAN

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NOTE ON HAEMOGLOBIN

DURING the course of a spectrographic examination of horse and fowl haemoglobin we have noted that the absorption band, whose peak appears at AU4100 for oxyhaemoglobin and AU4300 for haemoglobin in solutions of the above compounds, does not appear when washed corpuscle suspensions containing haemoglobin and oxyhaemoglobin in similar concentrations are examined. Furthermore the absorption which begins at AU2500 in solutions of horse haemoglobin also is absent when haemoglobin or oxyhaemoglobin is observed in washed cell suspensions. The specific bands in the visible regions of solutions of the above pigments are observed in the washed cell suspensions in their usual location.

Apparently there is, in the case of haemoglobin in the cell, a possibility that it is in combination with some constituent of the corpuscle. This problem is one of several concerning the blood pigment for which we are attempting to find a solution.

A. BRUCE MACALLUM
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A FOSSIL MAMMAL WITH UNBORN TWINS

THE South Dakota State School of Mines has recently mounted and placed on exhibition in its geological museum a most unusual fossil vertebrate specimen from the Oligocene of South Dakota. This is a superbly preserved skeleton of a mother *Oreodon* (*Merycoidodon*) *culbertsoni* with unborn twins. It is the only known occurrence of a fossil mammal accompanied by unborn young.

The specimen was found by the School of Mines collecting party of 1928, Mr. James Bump, Mr. Robert Hernon and Mr. Harold Martin, in the Lower Oreodon beds of Cain Creek, about two miles north of Imlay in the heart of the Big Badlands. Only a small portion of the skull of the mother was exposed to the weather. Excavation disclosed the complete skeleton except that the ribs on the right side were mostly missing. Upon turning over the block in the field for final shellacking and other protection, the skulls of two unborn individuals, lying within the pelvic region, were discovered. A photograph of the rough block made in the preparing room before work was begun upon it shows in good way much of the skeleton of the mother and the positions occupied by the twins.

The mother skeleton, the right side showing, is mounted in relief on a nicely tooled slab. The skeletons of the twins are only partially preserved. Some of this loss is due doubtless to the cartilaginous, nonpetrifying nature of the material. The better portions are the skulls and some of the larger leg bones. The skull of one is well preserved and nearly perfect. The other may be easily discerned but is much crushed and the parts displaced. Both skulls show well-developed teeth. The cranial bones are very thin and delicate and much care was necessary to prevent injury to them. In the mounting of the specimen

it was thought advisable not to attempt extracting the fetal forms completely from their matrix. They were mounted with the mother skeleton pretty much as found without attempting, however, to place them in theoretically exact position.

The School of Mines has had a collecting party in the White River Badlands during the last six field seasons. The results of this work have been most gratifying in that the institution now has a large collection, representative of this important life period, much of which has been prepared, mounted and placed on exhibition. The collection contains an especially good representation from the Protoceras channel beds.

CLEOPHAS C. O'HARRA
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BABYLONIAN MATHEMATICS

IN my address on "Mathematics before the Greeks" recently published in SCIENCE[1] I quoted a statement from Smith's "History of Mathematics"[2] to the effect that "in a tablet from Sennacherib's palace (about 700 B. C.), now in the British Museum, a circle is divided into 480 equal parts." Professor Smith does not give any authority for this statement but informed me privately that he probably learned of the fact during a visit to the museum. On appealing to Mr. C. J. Gadd, of the Department of Egyptian and Assyrian Antiquities, I learned recently that the tablet in question was almost certainly the one numbered K90, discussed by Hincks, and Bosanquet and Sayce, and referred to by more than one historian of mathematics. Mr. Gadd drew my attention also to an important discussion of this tablet by F. X. Kugler, in his "Sternkunde und Sterndienst in Babel," 2. Buch, 1. Teil, 1909, pp. 45–50. The views of Hincks rather than those of Bosanquet and Sayce are here upheld. In this connection Kugler refers to an article by Schiaparelli in *Scientia,* vol. 3, 1908; this is also in Schiaparelli "Scritti sulla Storia della Astronomia Antica," vol. 1, 1925, see especially page 23.

In the paragraph just before the last of my address I summarized, in about a dozen lines, some of the astronomical knowledge of the Babylonians. My friend Professor Cajori inquired if I intentionally omitted any reference to the Babylonian discovery of the precession of the equinoxes. This was a discovery of about 350 B. C. and hence should hardly be included in a survey of "Mathematics before the Greeks." It is, of course, a matter of great interest, and in my recently published "Bibliography of Egyptian and Babylonian Mathematics" I refer to Schnabel's important paper on the subject (1927) as well as to Professor Cajori's review of it in SCIENCE.[3] Schnabel's article seems to have been developed from a part of Kugler's work, mentioned above, published in 1924.

R. C. ARCHIBALD
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USEFUL GREAT TOES

A NUMBER of years ago, in the Louvre Galleries, in Paris, an artist who was born without any arms was a familiar sight. He was painting copies in oil of the principal masterpieces in the gallery and made thereby a comfortable living. That fact shows that the copies were of good quality.

But every one would ask at once how *could* he copy these paintings in oil without any hands? It was done entirely by means of the, to us, useless great toes and their next neighbor, the second toes. He held the brushes between these toes.

One morning when I happened to be in the gallery at the usual hour for the *déjeuner à la fourchette,* I saw him just finishing his meal. He seized a pint bottle with the left toes and grasping the cork with the corresponding toes on the right foot uncorked the bottle, lifted it to his mouth and after drinking all that he wished replaced the cork with the right toes and then with the sole of the right foot gave it a smart tap to replace it firmly.

W. W. KEEN

SCIENTIFIC BOOKS

Revision of the American Chipmunks. By ARTHUR H. HOWELL. North American Fauna, No. 52. U. S. Department of Agriculture, Bureau of Biological Survey. November, 1929. 157 pp.

THE appearance of the "Revision of the American Chipmunks," long known to be in course of preparation, is a zoological event of importance. These animals, so attractive to every lover of nature, are of more than ordinary interest to students of evolution on account of the great number of local forms. Modern methods have made it possible to deal with the subject very thoroughly, no less than 14,554 specimens having been examined. Sixty-five species and subspecies are recognized in North America, including Mexico. There are chipmunks also in northern and northeastern Asia, and it is found that the whole series falls into three main groups, the Asiatic *Eutamias,* the western American *Neotamias* (defined

[1] SCIENCE, 71: 109, January 31, 1930.
[2] Vol. 2, p. 230.
[3] SCIENCE, 65: 184, February 18, 1927.

and named in the work reviewed) and the eastern American *Tamias.* The two latter overlap in the region around Lake Superior. Singularly enough, the Siberian *Eutamias* resembles in a number of characters the eastern American *Tamias;* so much so that Pallas in 1778 thought that the Siberian and American animals were mere forms of a single species. However, the dentition of *Tamias* is the most modified, the upper premolars being reduced to two, instead of four as in the other two groups. Howell treats *Tamias* and *Eutamias* as genera (following the current usage of modern authors), and *Neotamias* as a subgenus of the latter. The probable inference would seem to be that *Eutamias* represents most nearly the stem-form, having at an early date sent to America the ancestors of *Tamias,* and more recently those of *Eutamias,* which, being a livelier and more variable animal, supplanted *Tamias* in the west. This is at present mere guessing, but it may be that fossil *Tamias* will be found in the west some day.[1] The characters and distribution considered, there is perhaps some basis for considering *Neotamias* a genus (type *Neotamias merriami* Allen).

When we come to the species and subspecies, there is very much of interest. In *Tamias,* Howell recognizes one species with five subspecies. In *Eutamias* (*Neotamias*) he has sixteen species and sixty forms in all, including subspecies. The subspecies are found to intergrade and it is to be determined whether these intergradations are directly related to the environment or whether they are due to crossing between races which meet each other in some part of their range. That the environment affects the characters is shown by the repeated development of dark or richly colored animals in humid districts, and pallid ones in drier districts. An interesting case is that of *Eutamias minimus caryi,* which occurs only in the dry lowlands of the San Luis Valley, Colorado, while the mountains northward, eastward and westward are occupied by the larger and darker *E. minimus operarius.* At 8,200 feet specimens were found connecting these races. Reviewing the numerous cases of intergradation recorded, one is struck by the various combinations of characters, exactly as in the case of hybrids. It seems certain that we have to do with hybridization in the majority of instances, and this in itself need not necessarily indicate subspecific rather than specific rank. But in any case, the "subspecies" are closely allied, and their precise rank is a matter of minor importance.

Although the work has been so thoroughly done, the subject is by no means exhausted. There are still many localities where collecting is desirable, and additional forms may yet be found on isolated mountain ranges. Hybridization in captivity should be attempted. Many anatomical features have yet to be compared in the different forms, for example, the auditory ossicles, the alimentary canal, the musculature. Although it is outside the scope of Howell's revision, one would like to see a chapter on the internal and external parasites and the predatory enemies. The food habits are treated interestingly and quite fully by Howell, who also discusses nesting habits and hibernation. We are not quite sure that the chipmunks would approve of a picture of a weasel on the cover of the work.

The bulletin may be purchased for a trifle, but we wish the government would use better paper and type for such important papers of permanent value.

T. D. A. COCKERELL

BOULDER, COLORADO,
DECEMBER 21, 1929

[1] An extinct species, *Tamias nasutus* Brown, has been found in the Pleistocene of Arkansas.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE SPOT-PLATE TEST FOR NITRATE NITROGEN IN SOIL AND OTHER EXTRACTS

THE diphenylamin test, usually conducted as a "ring" test, gives purely qualitative results. The blue color that appears in the ring test is lost when the sulphuric acid reagent and the liquid to be tested are mixed together, since it occurs only in sulphuric acid concentrations of 70 to 90 per cent. There is a definite need for a quick and simple nitrate test for soil extracts, drainage waters, plant juices or plant extracts that gives approximate quantitative results. For instance, in the field of soil science, it is desirable to study the nitrate nitrogen content of the soil from day to day or from week to week during the growing season. Exact quantitative measurement by the phenyldisulphonic acid or Devarda's alloy methods is laborious and the delay involves a loss of valuable time before necessary corrective steps can be made, as is the case when the soil drops so low in nitrate nitrogen content as to fail to nourish the plant properly.

The author has applied the principle of the very sensitive diphenylamin color reaction to a spot-plate technique. The reagent is a freshly prepared solution of 0.05 gm of diphenylamin in 25 cc of concentrated C. P. sulphuric acid. This is conveniently used from a glass-stoppered bottle of clear glass. The writer has attempted to use amber glass contain-

ers, but for some reason the reagent is contaminated by contact with the ground glass stopper of the amber-colored dropping bottle. Hence it seems preferable to make up at once only a sufficient amount of the reagent for use within two or three days' time, rather than attempt to store it in only partially light-proof bottles which might produce contamination.

A common artist's slab with circular depressions one inch in diameter and one fourth inch deep is the most convenient vessel for conducting the test. One drop of the solution to be tested is transferred to one of the depressions by means of an eye-dropper pipette. Four drops of the reagent are added, and the liquid stirred with a two-inch glass rod until a full color develops, which requires about two minutes. The intensity of the blue color is an approximate quantitative measurement of the nitrate nitrogen content, within the limits of from 1 to 25 p.p.m. of nitrates expressed as nitrogen. Above about 25 p.p.m. the blue color is so intense that little variation can be observed. In such cases the liquid to be tested must be diluted five, ten or more times, so that one drop of the diluted liquid will fall within the above limits. In such cases the final test is on the basis of one drop of the diluted liquid to four drops of the reagent, with calculation of results on the basis of the dilution.

A color chart of satisfactory accuracy can be made up with water colors. The color blocks in Ridgway's "Color Standards and Nomenclature," that most closely approximate the chart used by the author, is as follows:

Nitrate nitrogen concentration p.p.m.	Color name	Book Plate 1 No.
1	Pale forget-me-not blue	XXII
2	Pale violet blue	IX
3	Light violet blue	IX
5	Dull violaceous blue	XXII
7	Phenyl blue	IX
10	Helvetia blue	IX
15	Hays blue	IX
20	Cyanine blue	IX

The purity of the reagent can be ascertained by a blank test with one drop of distilled water. If no permanent blue color appears, the reagent is satisfactory for use on that day.

The results of the author and one of his associates in the determination of nitrate nitrogen in the leachate from 136 greenhouse lysimeters containing seventeen different soils, some pots of which had been previously treated with urea, both with and without lime, are of interest as an evidence of the accuracy of the spot-plate test. One person made the nitrate-nitrogen determination by the accurate phenyldisulphonic acid method, while the other conducted the spot-plate tests. Results were compared subsequent to recording the results. Space does not permit publication of the individual results, but the following table summarizes the data in comparative form:

No. of samples in group	Exact method NO_3-N p.p.m.	Spot-plate tests NO_3 N p.p.m. range	Spot-plate tests No. of samples within group limits
23	0– 20	0– 25	20
18	21– 50	20– 75	14
27	51– 100	30– 150	19
28	101– 200	75– 300	20
19	201– 350	200– 500	16
15	351– 500	300– 600	11
6	501–1000	500–1000	5

Several applications of this test suggest themselves. For soil tests, the author employs the special porcelain block used in connection with the LaMotte-Morgan Soil Testing Set to obtain the soil extract. Where the soil compartment of this block is filled to its normal capacity and distilled water permitted to soak through the soil in amount sufficient to fill the test cup, one drop when transferred to the artist's slab and tested for nitrates as described above gives results in p.p.m. of soil extract which can be interpreted as pounds of nitrate nitrogen per acre to plow depth. Dilutions are employed when necessary.

Another very important use of the test is the determination of nitrates in expressed plant juices and extracts. A suggested method is the maceration of small portions of fresh plant tissue in one compartment of the artist's slab, the addition of a drop or two of water if necessary in order to obtain a drop of expressed juice for transfer and the subsequent test. Good results have been obtained with green tissue in studies of the nitrate content of newly developed nodal portions of herbaceous pasture and forest plants.

M. FRANCIS MORGAN

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THE CAPNOMETER, AN INSTRUMENT FOR THE MEASUREMENT OF AIR POLLUTION

FROM the beginning of Mellon Institute's Air Pollution Investigation, a year ago,[1] it was recognized that the photoelectric cell would play an important part in the determination of the amount of atmospheric contamination and its distribution outward and upward from sources. Sampling devices ordinarily enable one to estimate the content of solids in a small volume of air at a given time and place, or the total amount at a given place over a period of

[1] L. W. Bass, SCIENCE, 70: 186, August 23, 1929.

time. It was desirable, however, for us to have a continuous record, not only of the amount of pollution, but also of the effects of atmospheric conditions upon the distribution of solids after their emission from stacks or other sources.

With the helpful cooperation of members of the staff of the Westinghouse research laboratories, experiments were made first for work at short range, and in consequence a combination has been developed that may be used at night or in the daytime. It consists essentially of a source light with a modulator, a receiver and amplifier, tuned, and an indicator or recorder, calibrated. It differs from "smoke indicators" in that it need not be attached to a smoke-pipe or stack and also in that it operates independently of any influence from daylight or artificial light other than that from the controlled source.

At the suggestion of W. A. Hamor, assistant director, Mellon Institute, the apparatus has been named the *capnometer* (> Greek *kapnos,* smoke, and *metron,* measure), for its purpose is to measure smoke—*capnometry.*

From the results of the work done in the laboratory, there is every indication that the apparatus will be very helpful in the capnometric part of Mellon Institute's program and in securing data concerning the influence of furnace and firing conditions, precipitation, wind velocities, etc., upon the density due to pollution of the atmosphere.

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SPECIAL ARTICLES

A THEORY OF THE RING METHOD FOR THE DETERMINATION OF SURFACE TENSION

DURING the last few years several papers concerning various phases of the ring method for the determination of surface tension have appeared in SCIENCE. It is desirable that this discussion also appear here especially because it is closely related to one of these papers. An experimental study of the ring method by Harkins, Young and Cheng[1] has shown that this method, as usually carried out, does not give true surface tension values. The results of Harkins and his collaborators are expressed in the form of a series of empirical correction curves which involve a value of the surface tension given by an absolute method. They have demonstrated that the value of the surface tension as given by the pull on a ring and the relationship

$$W = 4\pi R\gamma \qquad (1)$$

must be modified by these correction curves if that value is to be regarded as being, in fact, that of surface tension. The purpose of this preliminary paper is to announce that a theoretical basis for this empirical correction procedure has been developed, thus making the ring method, as modified, an absolute one, since by it surface tension may be determined without reference to any other method.

The basis of our theory is Laplace's equation for stable liquid surfaces expressed in the particular form applicable to surfaces of revolution, with the capillary constant (a^2) eliminated,

$$\frac{du}{d\bar{x}} + \frac{u}{\bar{x}} = \pm 2\bar{y} \qquad (2),$$

where u is the sine of the angle made by a tangent to the surface at any point $(\bar{x}, \bar{y})$ with the $\bar{x}$-axis. The $\bar{x}$-axis in this case is chosen at the undisturbed level of the liquid, and the $\bar{y}$-axis is the axis of symmetry. In this form the equation expressed shapes of surfaces, not their actual dimensions. If the latter are to be expressed, a^2 or its equivalent $\frac{2\gamma}{gd}$ must be known, where γ and d are respectively the surface tension and density of a particular liquid. Barred symbols as used by us are dimensionless, thus $\bar{x} = x/a$ and $\bar{V} = V/a^3$. But we shall speak of them, for convenience, as lengths and volumes. This equation formulates the shapes of all types of stable liquid surfaces of revolution. The ring method involves two of these types, the meniscus and the surface held up by a wetted disk. To get the actual shapes of these surfaces the equation must be integrated, which must be done in this case by series.

The shapes of the meniscus formed inside the ring are obtained by numerical integration in the ordinary way. But the integration for the outer slope presents a difficulty in that there is no known point at which to start. We have obviated this difficulty by an assumption which, however, introduces an error much less than any in the experimental procedure. These two integrations give a cross section of the liquid raised by the ring in any position. It takes the form of two curves tangent to a circle, one curve being the shape of the meniscus, the other being that of the outer slope, and the circle being the cross section of the wire, of radius r, of which the ring is made.

The volume below these surfaces is calculated. It

[1] Harkins, Young and Cheng, SCIENCE, 64: 93, 1926.

is found to pass through a maximum as the distance of the ring from the x-axis increases. Our theory identifies the weight of this maximum volume below the surfaces with the maximum pull on the ring as found experimentally. Harkins, Young and Cheng plot a function of this maximum pull, R^3/V, where R is the radius of the ring and V is the volume of the liquid equivalent to the weight measured by this pull, against γ/p, a curve for each value of $\frac{R}{r}$, where γ is the surface tension of the liquid as determined by a reference method, and p is the pull on the ring divided by $4\pi R$. We show that γ/p is equal to $2\pi\overline{R}/\overline{V}$, a ratio which does not involve the determination of γ by any other method. Now the correction curves found by Harkins and his collaborators are identical with the curves calculated by us from the maximum volume below the surfaces and plotted as indicated, *i.e.*, $\overline{R}^3/\overline{V}$ by $2\pi\overline{R}/\overline{V}$ for a particular $\overline{R}/\overline{r}$. Our calculated curves are probably not as precise as the experimental ones because of the lack of sufficient calculated surfaces and the errors due to the consequent interpolations. But the excellent agreement that is obtained shows that the same values of γ, within the small error of both methods, are obtained whether the relative corrections of the Harkins procedure or the absolute corrections as calculated by us are used. Thus the ring method may now be considered an absolute one, since by it surface tension may be determined without reference to any other procedure. A detailed discussion of this theory is to be published soon.

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PROLONGED EFFECT ON DIGITALIS PURPUREA OF EXPOSURE UNDER ULTRA-VIOLET-TRANSMITTING GLASS

FOR the past three years, a study has been made of the effect produced upon *Digitalis purpurea* L. by exposure in the greenhouse stage under an ultra-violet-transmitting glass. *D. purpurea* is well known as the common garden foxglove, and is also a very important medicinal plant. In 1927 and again in 1928, seedlings were grown about three months under an ultra-violet-transmitting glass, with controls under ordinary glass in an adjacent section of the same greenhouse. Thus it was possible to eliminate differences of temperature, moisture and other factors.

Both series were then grown in adjacent beds under open field culture conditions; and in each year, as reported[1] at the Nashville and New York meetings, the treated plants proved considerably superior to their controls in the content of the characteristic active principles.

The final report now to be given concerns the history of the 1928 plants during their second season of growth, this species being biennial. By careful mulching they were brought through the winter in good condition. Our capricious Michigan weather in 1929 made it necessary to water the plants last summer throughout a season marked by severe drought; but all were treated the same, and had attained the normal early blooming stage at the time the samples were harvested.

For many years it was held that second-year leaves were more potent than first-year herbage but eventually this idea was refuted. We now know from numerous tests that greater activity occurs during the first year of a digitalis plant's life. Therefore, it is to be noted that the actual percentages now given, obtained from second-year growth, are not as high as those previously reported from first-year leaves; but the relative values are again confirmed; the treated plants have the higher potency. Exact values are as tabulated below, all methods having meticulously followed those heretofore used.

Treated group	250 per cent. of standard
Control group	165 per cent. of standard

Increase of potency, 51.5 per cent.

It thus seems clearly established that *D. purpurea* is benefited permanently by exposure during seedling development under glass that affords an increased amount of ultra-violet radiation. Where digitalis passes its whole cycle under natural, out-of-door conditions in a mild climate, this fact may not be of great significance, but for successful culture of high-grade plants in Michigan we must depend in large measure upon indoor protection during the seedling stage. It is gratifying, therefore, to know that modern methods of glass making have increased the efficiency of greenhouse propagation.

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[1] A. McCrea, SCIENCE, 67, No. 1732, 1928; 69, No. 1798, 1929.

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